

## TWO NEW SPECIES OF *ABANTIADES* HERRICH-SCHÄFFER (LEPIDOPTERA: HEPIALIDAE) FROM WESTERN AUSTRALIA

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### Abstract

*Abantiades lineacurva* sp. n. and *Abantiades argentangulum* sp. n. are described, illustrated and compared with other Australian species of Hepialidae.

### Introduction

The genus *Abantiades* Herrich-Schäffer is endemic to southern Australia, with the northernmost occurrence listed by Tindale (1932) as Rockhampton, Queensland. The genus was last revised by Tindale (1932), who included 14 species, six described as new. Tindale's revision formed the basis of the works by Nielsen (1996), Nielsen *et al.* (2000), Edwards (2007) and Kallies and Douglas (2008). Since 1932, nothing of significance has been published on this genus and no new species have been described.

The genesis of this paper was a reorganisation of the South Australian Museum hepialid collection, which contains approximately 500 specimens of *Abantiades*, including all the described species. Curation revealed specimens of two unnamed species from Western Australia. Subsequent examination of the hepialid collection in the Australian National Insect Collection revealed two more unnamed Western Australian species.

In this paper we describe two new species from these collections.

Terminology used for the genitalia follows Dugdale (1994); that of the wing venation follows Kristensen (1998).

Abbreviations: ANIC – Australian National Insect Collection, Canberra; CSIRO – Commonwealth Scientific and Industrial Research Organisation; BMNH – The Natural History Museum, London, UK; SAMA – South Australian Museum, Adelaide; WAM – Western Australian Museum, Perth.

### Systematics

Tindale (1932) described *Abantiades* thus: 'Antennae unipectinate often broad and lamellate in males, reduced in females. Labial palpi three-segmented, first and second segments approximately equal, apical one short, about as long as wide and subspherical, maxillary pair reduced, forming ill-articulated protuberances at base of labium. Forewings R1 separating from Rs before the branching of R5; R4 and R5 forked. Hindwings with R4 and R5 branching before the radio-median cross-vein.' The type species is *A. hyalinatus* Herrich-Schäffer, 1853, designated by Kirby in 1892.

*Abantiades lineacurva* sp. n.

(Figs 1-7).

*Types.* *Holotype* ♂, WESTERN AUSTRALIA: Kojonup, 18.iv.1960, Wallace, in ANIC. *Paratypes*: 21 ♂♂, 6 ♀♀, WESTERN AUSTRALIA: 1 ♂, 1 ♀, Kellerberrin, 14.v.1939, Tindale; 1 ♂, Kojonup, 6.iv.1960, Beresford, in SAMA; 1 ♂, Kojonup, 11.iv.1961, Priest; 1 ♂, Kojonup, 11.iv.1962, Peters; 1 ♂, 1 ♀, Nedlands, 22.iv.1964, 21.iv.1964, Wallace; 15 ♂♂, 2 ♀♀, Kojonup, 10.iv.1963, 13.iv.1963, 17.iv.1963, 21.iv.1963, 22.iv.1963, 23.iv.1963, 14.iv.1964, 16.iv.1964, 17.iv.1964, 19.iv.1964, 21.iv.1964, 4.v.1964, 12.iv.1965, 19.iv.1966, 8.v.1967, Rogers; 1 ♀, Bakers Hill, 9.v.1968, I. Southey, in ANIC; 1 ♂, Jacup, 1.v.1914, W.B. Alexander, 33°46'S 119°17'E, in WAM.

*Additional material examined.* WESTERN AUSTRALIA: 1 ♀, Katanning, 1879; 1 ♂, Hale, 8.vii.1872, Bailey; 2 ♂♂, Jacup, v. 1914; 1 ♂, Jacup, v.1919; 1 ♂, Carlingup, v. 1919, in WAM.

*Diagnosis.* Male and female: antennae paler at tip with broad flattened rami; forewing dark brown with a prominent 'T' shaped silver-white marking which does not reach apex, without intricate scroll-like pattern; hind wing dark brown, only slightly paler towards base.

*Description.* Male (Fig. 1). Head: proboscis absent; labial palpi three segmented, apical one short sub-spherical, narrow, directed forwards; antennae red brown, paler towards tip, short, about a third length of costa, unijugate, rami in middle about 2.0-2.5 x shaft, sub-elliptical in shape, covered in very short fine cilia (Fig. 7), leading edge flattened; frons and vertex with dark brown hair scales. Thorax: densely covered in dark brown hairs, legs dark brown. Abdomen: densely covered in dark brown hairs.

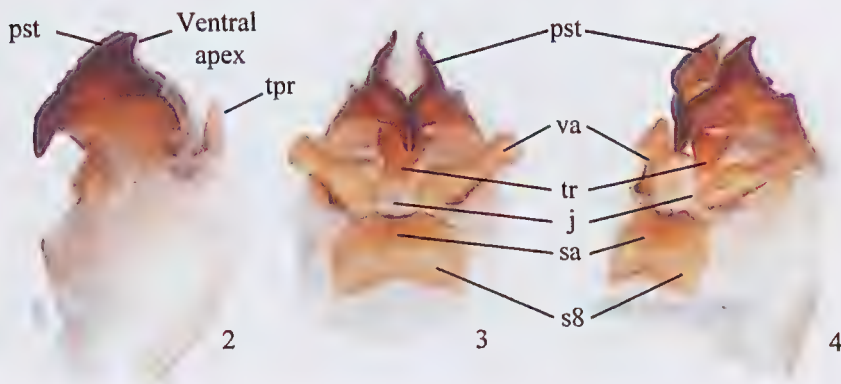
Forewing: length 30-34 mm, costa straight, gently rounded towards tip, termen and dorsum evenly and continuously rounded; upperside dark brown with silver markings and without intricate scroll-like pattern, a fine silver subterminal disjointed line from Rs2 to below CuA1, a parallel silver disjointed line subapically from Rs1 to postmedially below CuA1, from the middle of this line there extends a long longitudinal angularly undulating line to the costal vein near base, a short disjointed silver line, sometimes obsolete, runs from Rs1 inwards and not reaching Rs3, cilia dark brown. Hindwing: costa slightly arched, apex rounded, termen and dorsum evenly rounded, dark brown, slightly paler basally, cilia dark brown; underside of both wings dark brown with muted silver pattern showing through forewing.

*Genitalia.* (Figs 2-4). Pseudotegumen heavily sclerotised, wedge shaped, ventral apex projected rearwards in a strong curve, tip obtuse, anterior vertex 'beak-like', anterior margin somewhat serrate, posterior margin less. Each side of pseudotegumen curves outwards then narrows as it rises towards apex, lateral edge curves outwards at apex producing a mild horned effect in most specimens. Twin processes short, set well back. Valva short, paddle

shaped, dorsal edges more heavily sclerotised. Trulleum sclerotised, roughly trapezoid in shape with anterior apices lobed. Juxta; weakly bilobed, weakly sclerotised. Saccus broadly 'V' shaped, posterior edge heavily sclerotised with two acute points at its midline. Sternite 8; posterior margin with sizeable concave notch.



Fig. 1. Adult male of *Abantiades lineacurva* sp. n.: upperside



Figs 2-4. Male genitalia of *Abantiades lineacurva* sp. n.: (2) lateral, (3) ventral, (4) ventrolateral. j = juxta; pst = pseudotegumen; s8 = sternite 8; sa = saccus; tpr = twin processes; tr = trulleum; va = valva.



Fig. 5. Adult female of *Abantiades lineacurva* sp. n.: upperside

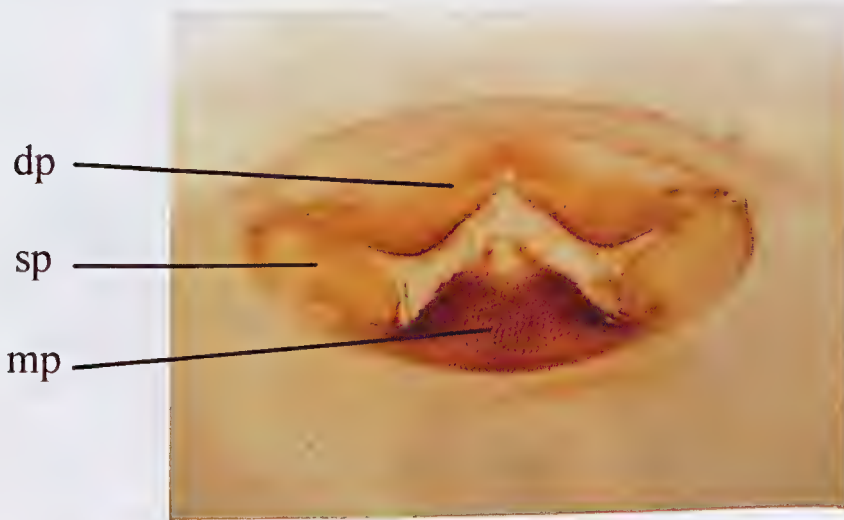


Fig. 6. Female genitalia of *Abantiades lineacurva* sp. n.: ventral view. dp = dorsal plate; mp = median piece; sp = side piece. Ductus bursae and corpus bursae not shown.

Female (Fig. 5). Head: proboscis and palpi as male; antennae as male but shorter, about one-sixth length of costa, unipectinate, rami mid antenna about 1.5 x shaft, strongly flattened and subelliptical, covered in very fine short cilia (Fig. 7). Thorax as in male. Abdomen densely covered in dark brown hairs. Forewing: length 50-70 mm, colour and pattern similar to male but more elongate. Hindwing similar to male but more elongate.

Genitalia (Fig. 6). Anogenital field wider than high. Dorsal plate lobes triangular, setose, lightly sclerotised. Median piece distinctly bi-cuminate, setose, heavily sclerotised. Side pieces sub-elliptical.



Fig. 7. Antennal segments of male (left) and female (right) of *Abantiades lineacurva* sp. n.: (a) terminal ramus, (b) mid rami-lateral view, (c) mid ramus.

*Variation.* The extent and detail of the silver markings on the forewings vary as in other species of *Abantiades*.

*Etymology.* *lineacurva* (Latin) – curved line referring to the longitudinal, angularly undulating silver line that is the most conspicuous forewing mark.

*Distribution.* Most specimens were collected at the CSIRO light trap at Kojonup. It is also known from the Perth area, Bakers Hill in the eastern Darling Range, Kellerberrin in the wheat belt east of Perth, and Jacup and Carlingup in the southern mallee (Fig. 8).

*Comments.* *Abantiades lineacurva* is the only Western Australian species that has grey-brown fore and hind wings and a prominent, single white line on the forewing. *Abantiades albofasciatus* Swinhoe, 1892 also has a single major white stripe on its forewing but it is wider, angled rather than curved, and reaches the apex. *Abantiades albofasciatus* also has intricate scroll-like markings on the upperside of the forewing and a hind wing that is white. *Abantiades aurilegulus* Tindale, 1932 is golden-brown rather than dark brown in colour and has two prominent lines on its forewing.



Fig. 8. Capture sites of *Abantiades lineacurva* sp. n.

*Abantiades argentangulum* sp. n.

(Figs 9-16)

*Types. Holotype* ♂, WESTERN AUSTRALIA: Yanchep National Park, 5 miles north of Yanchep, 12.iv.1968, I. Common and M. Upton, in ANIC. *Paratypes*: 7 ♂♂, 2 ♀♀, WESTERN AUSTRALIA: 1 ♂, Kojonup, 8 iv 1964 A. L. Rogers, in SAMA; 2 ♂♂, 1 ♀, Konjunup? 2-11.iv.1962, A.L. Peters; 3 ♂♂, 21 miles west of Kojonup, 28.iii.1968, I. Common and M. Upton; 1 ♂, Pithara, 25.iv.1968; 1 ♂, Peak Charles NP, 16.iv.2007, A. Zwick and C. Cocking; 1 ♀, Coolgardie Goldfield Woodlands NP, 17.iv.2007, A. Zwick and C. Cocking, in ANIC; 1 ♂, 1 ♀, Dryandra State Forest, 12.8 km SE of Caballin, 5.iv.1984, R.P. McMillan, in WAM.

*Additional material examined.* WESTERN AUSTRALIA: 4 ♂♂, Lake Magenta Reserve, 17 m E. Pingrup, 4.iv.1971, D. Kitchener and L. Smith; 1 ♂, Lake Magenta Reserve, iv.1971, L. Smith; 2 ♂♂, Dryandra State Forest, 12.8 km S.E. of Caballing, 5.iv.1984, R.P. McMillan; 1 ♂, 20 m N.E. of Corrigan, 15.iv.1963, A.C. Morton; 1 ♂, Gooseberry Hill, v.1970, E. Mullins; 1 ♂, Valema Farms, Corrigan, iii.2001-2002 Insect Survey, M. Golding and I. Pitman; 1 ♂, Gosnells, 21.iv.1939, W. Stevens; 1 ♂, Fitzgerald River National Park, 9-11.iv.1982, T. Houston; 1 ♂, Dryandra State Forest, iv.1972, A. Burbridge; 1 ♂, Glen Forest, 16.iv.1974, I. Lyon; 1 ♂, Carlingup, 3.vii.1914, W.B. Alexander; 1 ♂, West Perth, 1.iv.1937, A. Holder; 1 ♂, Shackleton,

31.v.1922, L. Morrison; 1 ♂, no data, M. Powell Collection; 1 ♀, Cheritons Find, 11.iv.1971, B. Evans, all in WAM.

*Diagnosis.* Male: antennae with broad flattened spade shaped rami; forewing dark grey-brown with two prominent, silver-white, triangle shaped markings; hind wing mid brown, more yellowish towards base. Female: antennal rami absent; forewing grey with scroll pattern.



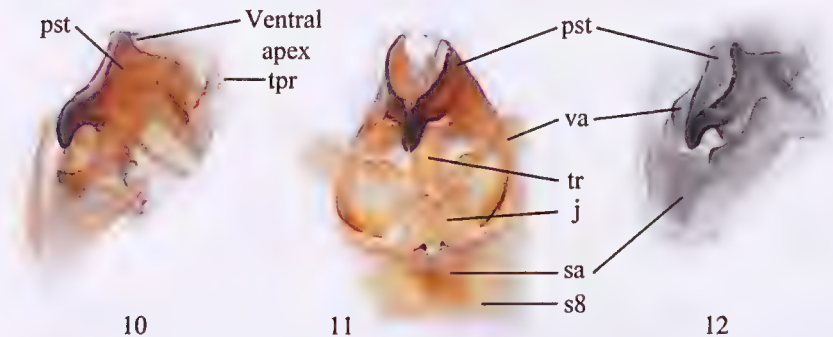
Fig. 9. Adult male of *Abantiades argentangulum* sp. n.: upperside.

*Description.* Male (Fig. 9). Head: proboscis absent; labial palpi three segmented, apical segment short, subspherical, directed anteriorly; antennae, 65-73 segments, dark chestnut-brown, short, about a third length of costa, unipectinate, rami mid filament 3 x shaft, strongly flattened, at base sub-elliptical, mid antenna spade shaped, at termen near triangular, densely covered in short fine cilia (Fig. 16); frons, covered in long grey hairs. Thorax, covered in long brown hairs; legs, covered in stiff hairs; forelegs, femur inner yellow, outer black, edge white; tibia, brown and yellow; tarsi, grey tipped white; mid legs, all grey tipped white; hind legs yellow. Abdomen covered in long dark, grey-brown hairs.

Forewing: length 52-60 mm, costa straight gently rounded towards tip, tip acute, termen and dorsum continuously gently curved giving wing a narrow lanceolate shape, upperside, pale brown, darker at base; two large silver-white markings, one thin and lanceolate from near tip to below CuA1 approximately parallel to termen, second triangular with vertices at the origin of M3, join CuA1 with M3 and 0.4 distance along Rs4, both edged dark

brown, between, a sparse line of small circles edged mid brown; slight scrolling near dorsum, fine mid brown lines fill other spaces; close to termen a thin off white line runs between Rs4 and A1; underneath, light brown tending darker at the costa, coating of yellowish hairs to the basal part. Hindwing: costa straight, curving towards tip, tip obtuse, termen and dorsum evenly rounded; upperside light brown grading to yellowish buff at base; underside light brown, yellowish hairs at base.

Genitalia (Figs 10-12). Pseudotegumen; heavily sclerotised, ventral apex acute, triangular, with slight posterior projection, tip obtuse, anterior apex heavily hooked, anterior margin somewhat concave, posterior sinuously curved, thickened, bumpy. Twin process; short, strongly pointed. Valva; 'arms' short, broad at base, rugose, curved and sclerotised along ventral surface. Trulleum; large, lightly sclerotised, angled posteriorly, anterior apices lobed. Juxta; weakly sclerotised, large, posterior roundly bilobed, anterior lateral acute lobes. Saccus; broadly 'V' shaped, curved anterior apex, posterior with two sclerotised points along midline. Sternite 8; posterior margin gentle convex curve.



**Figs 10-12.** Male genitalia of *Abantiades argentangulum* sp. n.: (10) lateral, (11) ventral, (12) ventro-lateral. j = juxta; pst = pseudotegumen; s8 = sternite 8; sa = saccus; tpr = twin processes; tr = trulleum; va = valva.

Female (Fig. 13). Head: proboscis and palpi as male, antennae dark chestnut-brown, short, one fifth costa, non pectinate, rami reduced to bumps that abut, producing an ongoing series of undulations along the length of the filament, well covered with short white setae over the entire surface, some longer setae on underside of filament (Fig. 16). Thorax covered in long brown hairs; legs mid to dark brown. Abdomen as male. Forewing: 77-90 mm, similar to male except the silver-white markings are replaced with subdued, non-contrasted, pale grey-brown areas, the spaces between filled with scroll-like markings. Hindwing: upperside similar to male but paler; underside light brown.





Fig. 13. Adult female of *Abantiades argentangulum* sp. n.: upperside.

Genitalia (Figs 14-15). Anogenital field wider than high. Dorsal plate; deeply cleft, lobes distinct, pear-shaped, setose, lightly sclerotised. Median plate, shape distinctly mound-like, setose, heavily sclerotised. Side plates roughly triangular. Intergenital lobe wide trapezoidal. The bursae copulatrix occupies the entire length of the female abdomen. Ductus bursae and corpus bursae of about equal length, diverticulum at intersection.

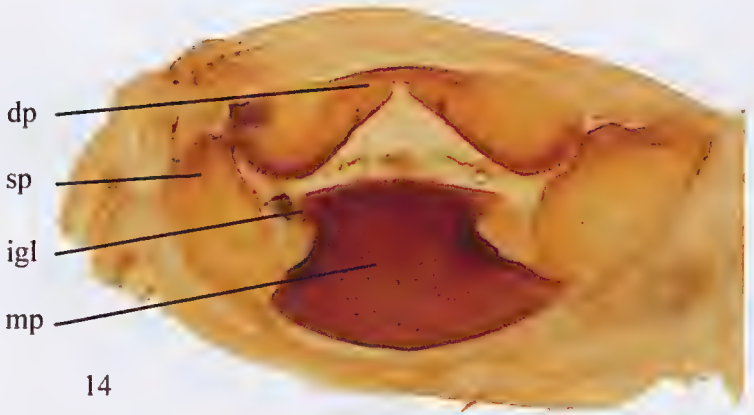
*Etymology.* *argentangulum* (Latin) – referring to the angular silver marking prominent on the forewing of the male.

*Distribution.* Widely distributed over the southwestern part of WA (Fig. 17).

*Comments.* *Abantiades argentangulum* is easily separated from all other Western Australian *Abantiades* species: males by the striking silver-white triangles on the forewings, females with rami absent from antennae. This species has been collected extensively in the past and has for many years been referred to as the ‘WA magnificentus’. It has only now been studied in sufficient depth to establish its specific status.

### Biology

We know nothing significant of the biology of either species, although rainfall data for the capture sites and times of the above mentioned specimens indicate that emergence of this species is linked to autumn and winter frontal rainfall events, similar to that known for other hepialid species.



14



15

**Figs 14-15.** Female genitalia of *A. argentangulum* sp. n.: (14) anogenital area; Ventral view, (15) bursae copulatrix. dp = dorsal plate; igl = intergenital lobe; sp = side piece; mp = median piece; db = ductus bursae; cb = corpus bursae; div = diverticulum.

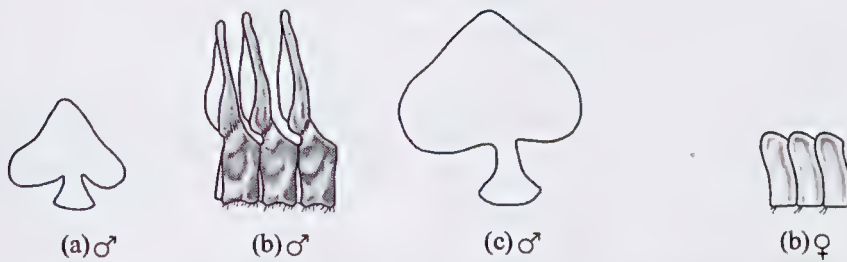


Fig. 16. Antennal segments of male (left) and female (right) of *Abantiades argentangulum* sp. n.: (a) terminal ramus, (b) mid rami-lateral view, (c) mid ramus.



Fig. 17. Capture sites of *Abantiades argentangulum* sp. n.

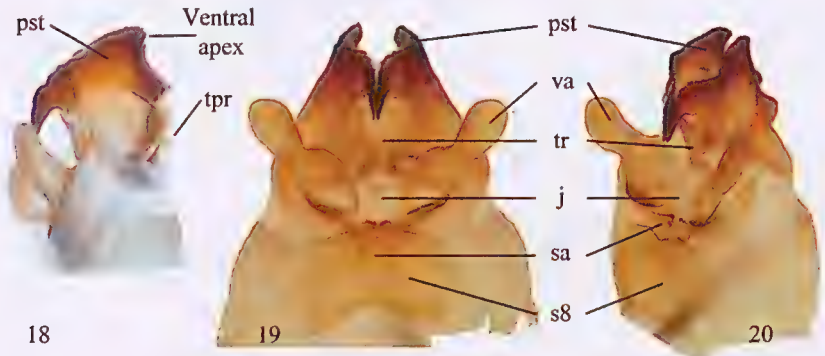
### Discussion

*Abantiades lineacurva* is similar to another Western Australian species, *Bordaia moesta* Tindale, 1932 in size, shape, colour and markings but differs in its appearance, antenna and genitalia. When describing *Bordaia* Tindale (based on the type species *B. pica* Tindale), Tindale (1932) noted that it has an appearance like *Oxycamus* Walker but venation like *Abantiades*, where R4

and R5 on both wings were stalked, whereas in *Oxycanus* R5 arises from the stem of R<sub>2+3+4</sub>. Unlike *Abantiades*, which has unipectinate antennae, *Bordaia* has bipectinate antennae.

*Bordaia moesta* was known for many years only from the holotype in SAMA but recently a further male has been discovered in the WAM collection. Both specimens have yellow bipectinate antennae, whereas *A. lineacurva* has deep reddish brown, unipectinate antennae.

Although the overall structure and form of the genitalia of *A. lineacurva* and *B. moesta* are similar, there are differences in the structures of various parts (Figs 2-4 and 18-20). In *A. lineacurva* the genitalia are more heavily sclerotised, the valva are broader and thicker, the trulleum smooth in outline with diverging anterior projections, the posterior margin of the juxta is distinctly linear, the ventral projection of the pseudotegumen is curved, acutely angular and backward pointing, and the twin processes much longer. The notch in S8 also differs. The anterior projections on the trulleum of *B. moesta* have an interesting spear-pointed shape.



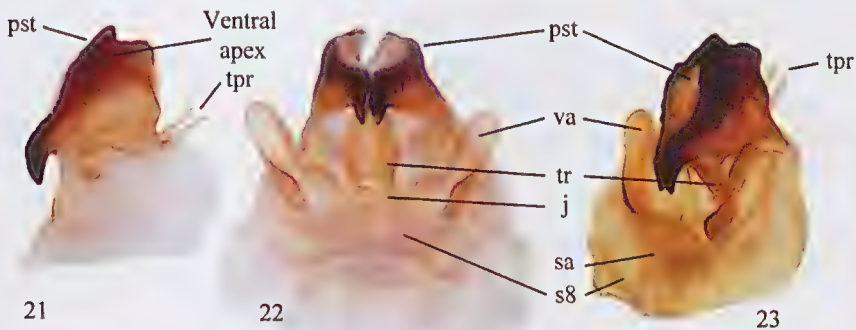
**Figs 18-20.** Male genitalia of *Bordaia moesta*: (18) lateral, (19) ventral, (20) ventro-lateral: j = juxta; pst = pseudotegumen; s8 = sternite 8; sa = saccus; tpr = twin processes; tr = trulleum; va = valva.

The close structural similarity of the male genitalia of *Abantiades* and *Bordaia* do, however, hint at a closer similarity than the antennal differences would indicate. A careful study of the generic limits of *Bordaia* and *Abantiades* is needed to clarify the position of these genera and this is being undertaken by Thomas Simonsen (BMNH) (pers. comm).

*Abantiades argentangulum* most resembles the eastern Australian *A. magnificus* (Lucas, 1898). The similarities in the two species indicate a close relationship. Males of both species have large, silver-white triangles on their forewings but in *A. argentangulum* the silver-white markings are relatively larger with a smaller area of dark brown scales surrounding them. Hind wings

on *A. argentangulum* are yellowish and distinctly lighter than the forewing, whereas in *A. magnificus* the hind wings are grey-brown and darker than the forewings. Antennae: in *A. argentangulum* the rami are larger, 3.0 x the filament width and, although not bilateral, are distinctly spade shaped, whereas in *A. magnificus* the plates are smaller, 1.5 x the filament width and orbicular to lanceolate in shape. Females of the two species can only be separated using genital structures.

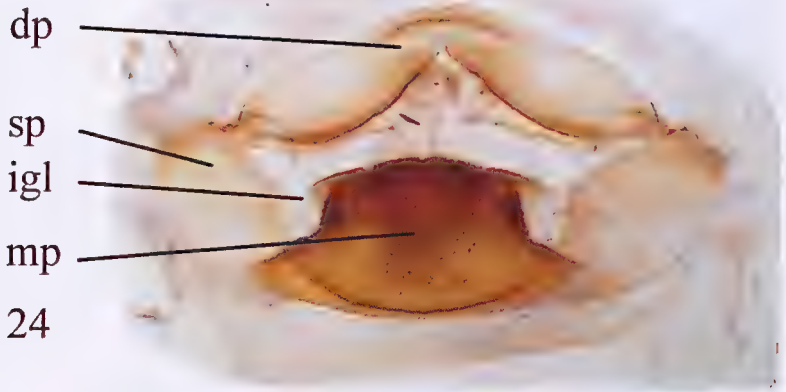
Comparison of the genitalia shows specific differences. In males (Figs 10-12 and 21-23), the slope of the posterior margin of the pseudotegumen in *A. argentangulum* is curved but distinctly stepped and steeper in decline in *A. magnificus*; the trulleum in *A. argentangulum* is longer with anterior projections present but pentagonal shaped and lacking projections in *A. magnificus*; the juxta in *A. argentangulum* has apical projections, is proportionally larger and has the posterior margin lobed but in *A. magnificus* is without apices, is proportionally smaller and lacking lobes on the posterior margin; valves with 'arms' relatively shorter in *A. argentangulum*.



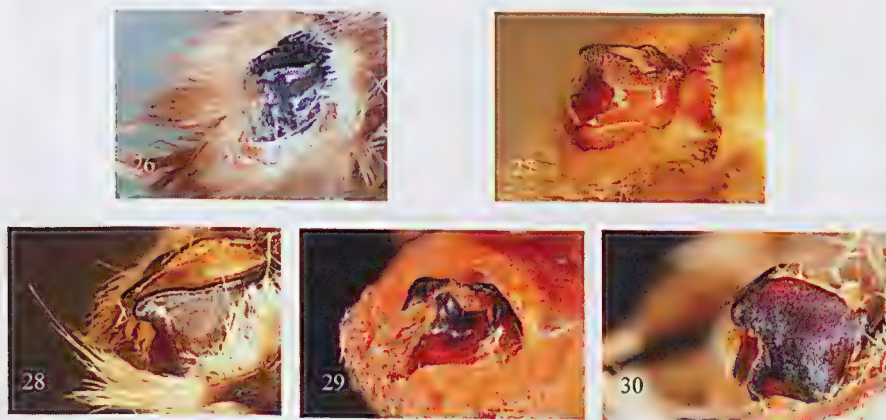
**Figs 21-23.** Male genitalia of *Abantiades magnificus* (21) lateral, (22) ventral, (23) ventro-lateral: j = juxta; pst = pseudotegumen; sa = saccus; tpr = twin processes; tr = trulleum; va = valva.

In females (Figs 14-15 and 24-25), differences can be found in the morphology of the dorsal plate (lobes in *A. magnificus* are more evenly rounded than in *A. argentangulum*) and of the bursae copulatrix (*A. argentangulum* has a diverticulum, *A. magnificus* does not).

*Abantiades argentangulum* is widespread in southwestern Australia, living in a wide variety of open woodland types. *Abantiades magnificus* is from eastern Australia, ranging from the New England area of NSW along the great divide to Moe and the Grampians. Neither species has been recorded in South Australia. On the basis of distinct morphological differences in overall appearance (in males), antennal shape (in males), genitalia structures, their geographical separation and their differences in habitat preference, we believe that *A. argentangulum* and *A. magnificus* are separate species.



**Figs 24-25.** Female genitalia of *Abantiades magnificus*. (24) anogenital area, (25) bursae copulatrix. dp = dorsal plate; sp = side plate; mp = medial plate; igl = intergenital lobe; db = ductus bursae; cb = corpus bursae.



**Figs 26-30.** Ventrolateral views of pseudotegumen; (26) *Abantiades lineacurva*, (27) *Bordaia moesta*, (28) *A. argentangulum*, (29) *A. aurilegulus*, (30) *A. hydrographus*.

### Remarks

When working with older specimens of Australian hepialids, care is required when describing colour differences. The appearance of specimens when first caught may be brighter and more colourful, with some colours fading or disappearing as the specimen ages. Irrespective of the age of the specimen, differences outlined above hold true.

In the genus *Abantiades* there seems to be two forewing shapes exhibited by the various species: longer, more lanceolate forewings such as in *Abantiades argentangulum* and a broader forewing as exhibited by *A. lineacurva*.

### Identifying *Abantiades* species without dissection

Sometimes it is convenient not to dissect the male genitalia, in which case parts of the pseudotegumen may be seen by brushing away some scales around the genital area (Figs 26-30). Tindale (1935) used this technique in studying *Oxycanus*. It has the disadvantage that important characters may be hidden; the degree of extrusion of the male genitalia in different specimens will differ and so will be more or less visible.

### Acknowledgements

We thank Peter Hudson for suggesting the project, his ongoing support, patience and forbearance in all things and for critically reading the manuscript, Chris Watts for his support, detailed reading and critical analysis of our writing, You Ning Su for his instruction on the use of the mounting camera and help and support with the imaging and computer graphics and Howard Hamon for his construction of the final images and distribution maps, Thanks must also be given to the staff of SAMA, WAM and ANIC for access to specimens and their equipment.

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